Claims

What is claimed is:

1. A method for remotely sensing air outside a moving aircraft, comprising:

projecting laser radiation into the air to induce scattered radiation that has a molecular scattered radiation component and an aerosol scattered radiation component;

detecting scattered laser radiation;

distinguishing the molecular scattered laser radiation component from the aerosol scattered radiation component; and

determining one or more air parameters based on the scattered radiation, the air parameters selected from the group of air speed, pressure, temperature and aircraft orientation angle.

2. A method of claim 1, wherein distinguishing comprises automatically analyzing a spectrum of the molecular and aerosol scattered radiation components.

3. A method of claim 2, wherein analyzing comprises measuring a spectral lineshape of the spectrum.

4. A method of claim 1, wherein distinguishing comprises distinguishing Rayleigh characteristics of the scattered radiation from Mie characteristics of the scattered laser radiation.

5. A method of claim 1, wherein determining velocity comprises determining a Doppler line shift of a spectral line shape of at least one of the molecular scattered radiation and the aerosol scattered radiation.

6. A method of claim 5, wherein a molecular scattered Doppler line shift is used in determining an air speed and an aircraft orientation angle at all flight altitudes and independent of aerosol distribution.

7. A method of claim 5, wherein an aerosol scattered Doppler line shift is used in determining an air speed and an aircraft orientation angle.

8. A method of claim 1, wherein determining temperature comprises determining a spectral line shape of the molecular scattered laser radiation and comparing the line shape to one or more theoretical Rayleigh line shapes.

9. A method of claim 1, wherein determining pressure comprises determining amplitude of a line shape from the molecular scattered radiation.

10. A method of claim 1, wherein determining pressure comprises determining a line shape from the molecular scattered radiation and comparing the line shape to one or more theoretical Rayleigh line shapes.

11. A method of claim 1, wherein projecting laser radiation comprises utilizing one or more tunable narrow linewidth lasers.

12. A method of claim 11, the lasers having a center frequency matched to one of a mercury vapor filter peak absorption frequency and an atomic vapor filter peak absorption frequency.

13. A method of claim 11, wherein projecting comprises dividing the laser radiation through a plurality of transceivers and optical fibers.

14. A method of claim 13, further comprising utilizing two or more transceivers mounted with the aircraft, wherein detecting comprises detecting the scattered radiation with the two or more transceivers.

15. A method of claim 1, wherein detecting scattered radiation comprising utilizing at least one of a fixed frequency atomic vapor filter and a fixed frequency mercury vapor filter

16. A method of claim 1, wherein distinguishing comprising deconvolving Rayleigh line shapes and Mie line shapes via digital signal processing.

17. A method of claim 1, wherein a spectral lineshape of the molecular scattered radiation component is used to determine the temperature and the pressure.

18. A system for sensing of air outside a moving aircraft, comprising:

at least one laser for generating laser energy;

at least one transceiver for projecting the laser energy to the air and for receiving scattered laser energy from the air;

a computer for processing signals from the transceiver to distinguish molecular scattered radiation from aerosol scattered radiation and for determining one or more air parameters based on the scattered laser radiation.

19. A system of claim 18, the parameters selected from a group consisting of air speed, pressure, temperature and aircraft orientation angles.

20. A system of claim 18, further comprising at least one of a fixed frequency atomic vapor filter and a fixed frequency mercury vapor filter.

21. A system of claim 20, the laser comprising a tunable frequency centered at an absorption wavelength of said filters.

22. A system of claim 21, the atomic vapor filters comprising one of mercury or cesium.

23. A system of claim 18, the laser energy comprising a wavelength in a range of about 254 nm to 355 nm.

24. A system of claim 18, the computer comprising means for deconvolving Rayleigh line shapes and Mie line shapes of the molecular and the aerosol scattered radiation.

25. A system of claim 18, further comprising optical fiber for coupling the laser to the transceiver.

26. A system of claim 18, further comprising a transducer for converting scattered laser radiation to electronic signals for the computer.

27. A system of claim 18, the system further comprising means for determining a temperature and a pressure within a region of the air without a prior knowledge of the air.

28. A transceiver, comprising:

beam steering optics for projecting laser energy to air; and

a vapor filter configured for filtering backscattered laser energy received from the air, wherein filtered backscattered laser energy is processable to determine one or more air parameters.

29. A transceiver of claim 28, further comprising at least one detector configured for receiving the filtered backscattered laser energy and for converting the filtered backscattered laser energy to electronic signals for use in determining the one or more air parameters.

30. A transceiver of claim 28, comprising a plurality of mirrors configured for directing the laser energy through the vapor filter.

31. A transceiver of claim 28, the beam steering optics comprising an optical connector configured for coupling to a laser generating the laser energy.

32. A transceiver of claim 28, comprising one or more mounts configured for mounting the transceiver within an aircraft.

33. A transceiver of claim 28, the beam steering optics comprising a lens.

34. A transceiver of claim 28, the air parameters selected from a group consisting of air speed, pressure, temperature and aircraft orientation angles.

35. A transceiver of claim 28, the vapor filter comprising a fixed frequency atomic vapor filter or a fixed frequency mercury vapor filter.

36. A transceiver of claim 28, the laser energy comprising a center frequency corresponding to a peak absorption frequency the vapor filter.